Was Edison an unusually creative individual or the product of this highly flexible era? I would suggest that he was both. He inculcated the values and style of his time and they reinforced his technical ingenuity. He valued growth, large scale production, and change—both technical and economic. His style was wholistic and integrative. Where given choices, he tended toward centralized production but with it tied closely to a network with individual control. We see that in the design of the Jumbo generator and in his integrated light-generation-distribution system as evidenced in the Pearl Street Station. Significantly, at the official opening Edison was not at the power station when the switch was thrown, but he was at the site of the consumer where he turned on the local switch. It was the central production of power but with control at the consumer end that was the objective.

While we might recognize, in mid-to-late 19th century American culture, a bias favoring centralization, one could still question whether there was any alternative to the central station for electrical generation. The answer, of course, is "yes." There was an alternative and had it been pursued we would likely live in a much different world today. Several Light Company stockholders encouraged development of isolated plants, but Edison remained deeply committed to the central station concept. Think today of what our world might be like if Edison had instead emphasized isolated plants. We might tonight drive home and attach our car to our small home power plant. The automobile would contribute additional generating capacity needed for the early evening hours. Instead of this, we now look forward to the possibility a decade from now of driving home our electric cars, plugging them in overnight, and drawing current from central power stations. Yes, there are alternatives and we, as creative engineers, managers, individual consumers, and a society, choose. In this case Edison, in the context of his culture and society, shaped our technology and industrial enterprise in a highly significant way by promoting central stations. Nonetheless, Edison carried out his culturally formed ideas with an insight, technical skill, and energy that few, if any, have ever possessed. His roughhewn, iconoclastic, and confident personality would not fit in a modern organization whether it be a school, university, institute, corporate laboratory, or local auto repair shop. Edison didn't last long in school and was constantly fired from the few jobs he ever held. He didn't exactly fit in the world of his time, but he did help create the world of our time.

One hundred years ago Edison "accomplished all he promised" with the opening of the Pearl Street Station, the foundation for our modern power industry. Just 50 years ago—last October—Edison died at the age of 84. The front page headlines of newspapers across the country were laden with the sad news. His death signaled an outpouring of tributes from around the world. It was at first suggested that our nation pay honor to him on the evening of his burial by turning off all the country's electric generating stations for one minute. Obviously this suggestion was not made by a power engineer! The impossibility of such a tribute soon became obvious and highlighted the nation's deep dependence upon what was so new just 50 years before at Pearl Street. But the President—President Hoover—suggested a voluntary shutting off of lights. At 9:59 PM on Wednesday, October 21, the lights at the White House were dimmed, the torch on the Statue of Liberty was darkened, Broadway sought to extinguish its brilliant marquees, and lights were turned off in millions of homes across the land in a momentary monument of darkness to a giver of light.

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# Electricity and Social Change

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The causes of social change tend to be obscured by the interacting mix of historical events. But often there are single developments which are major determinants of basic changes, and during the past century, a few technological trends have profoundly influenced our society.

This Centennial of the Pearl Street Station of the Edison Electric Illuminating Company of New York permits a retrospective look at the social significance of that event. As a pragmatic visionary, Thomas Edison considered this Station as an early step in the eventual electrification of our cities. He intuitively understood that electricity is a uniquely useful energy form, and that its use would spread rapidly.

The impact of electrification in shaping our society has continued to be profoundly significant. Electricity, and the many applications it made possible in all walks of life, together with the advent of such major innovations as the automobile, telephone, and radio, has made our present society basically very different from that of a hundred years ago. The widespread use of these technologies was heavily dependent on the entrepreneurial aggressiveness of their early parents, such as:

- Henry Ford, who created the affordable automobile for the common man and thus laid the foundation for changing the demography of urbanization and suburbanization.
- Bell's and Marconi's developments, which led to instant regional and international communication, and thus shrank the interacting commercial, political, and cultural world.
- Edison's development of an electricity delivery system which gave people access to a uniquely versatile energy form, capable of providing countless amenities and replacing much human toil.

In each of these fields there were many creative contributors, both in the United States and Europe, and these technologies would have come into commercial use eventually, even without the catalytic role of these specific individuals. Ford, Bell, Marconi, and Edison were, however, notable in their enterprising, bold, and innovative approach to the commercial opportunities provided by the new technologies. They made things happen sooner.

During this past century, electricity has become commonplace. Like water from a faucet, electricity comes from an outlet in the wall. Its effects on restructuring society have been profound, but subtle—so subtle, in fact, that much of the anti-electricity doctrine of some of today's vocal social critics is based on a fundamental misperception of its societal impacts. Thus, we find electricity condemned as a source of the growing centralization and depersonalization of society and its institutions when, in reality, it has been the foremost facilitator of decentralized patterns of economic and social activity. Let me review for you some of the aspects of electricity's role as the "great decentralizer," beginning with productive sectors of the economy.

Because electricity is relatively easy to deliver, its applications have decentralized energy-using activities, both within productive units, such as factories, and among geographic locations. The steam- and water-powered mills of the previous century required the work process to fit the large belt-driven main power shafts. The electric motor permitted a flexible and controllable source to be adapted to any process pattern.

Electricity also permitted wide geographic flexibility. Power lines allowed industry to locate wherever it chose. The U.S. industrial pattern is no longer determined by the proximity to water power, coal mines, or locations favorable to the transportation of coal, such as sites on navigable streams or close to railroad centers. The result of all this has been an acceleration in the growth of the overall efficiency with which the output of goods is produced, and an almost unnoticed energy conservation by-product—primary fuel consumption per unit of national output was reduced by about 40 percent during the period of most rapid penetration of electricity as a source of industrial power.

The advent of electric air conditioning has also profoundly shifted the demography of our nation. The growth of the sun belt has been made possible by our ability to mitigate the hot weather of that region. Even in the temperate climate of New York, the summer heat has been made acceptable by air-cooled dwellings, with measurable reductions in the heat-induced endemic illnesses of a dense urban population.

This improvement in public health is, of course, most marked in the handling of perishable foods. Our food cycle now is overwhelmingly dependent on refrigeration at all stages of supply. The modern supermarket and efficient food distribution would probably not be viable without it, as can easily be seen when visiting some of the less developed regions of the world. Diseases of the intestinal tract are endemic in such regions and result in major public health problems.

Most important, perhaps, is electricity's contribution to the freedom of individuals to choose their own lifestyles. The technology of the household has been altered historically by the flip of the switch. Housekeeping drudgery (laundry and cleaning, notably) has been substantially reduced—sufficiently to permit the housewife to engage in other activities. About half of all adult women are now part of the paid labor force, compared to about 20 percent in 1900. This move has been supported by automatic processes for performing major household tasks such as laundry, and by simplification of the traditional tasks of food preparation, by freezers, microwave ovens, motorized mixers, etc. In addition to providing a large addition to the nation's labor force, there is no question that the physical emancipation of women is steadily changing the cultural traditions of our society in ways that are becoming more discernible with every passing year.

Electricity, along with other forces leading to the growth in worker productivity, has resulted not just in an expansion in the volume and variety of goods consumed, but also in an increase in leisure. (Of course, one might say that the historical orthopedic ailment of "housemaid's knee" has now shifted to "tennis elbow"). However, it is interesting to observe that the proliferation of electric appliances has also produced a growing decentralization of recreational activities, with the home increasingly becoming a recreational center dispensing the entire range of the performing arts via television, and, more recently, a game center as well.

By the year 2000 about half of all our primary fuel sources will be used to generate electricity. Where will the continuing electrification of our society take us? Our labor force is gradually shifting from being a source of physical labor to being the controllers of mechanical work devices. Robots can work where people can't or shouldn't (deep mines or the sea bed); automated computer-controlled processes maintain the balanced flow through complex manufacturing sequences (the continuous casting steel mill); and communication systems can coordinate many widespread activities (air transport systems). The resulting work force mix has gradually shifted from the "blue collar" to the "white collar," and now the advent of the robot is giving us the "steel collar" worker. Electricity makes all these developments possible. Electrification is also a principal means of increasing our national productivity, lowering the real cost of goods and services, and thus raising the quality of everyone's lifestyle.

As for the bulk of the world's population which lives in less developed countries, visions of what the future should be (e.g., decentralized self-sufficiency, high growth, etc.) generally fail to illuminate the democratic equalizing nature of the reduced constraints on all types of lifestyles resulting from advanced technology. There are no technological constraints to eventually providing everyone in the world with the amenities and services characteristic of the industrialized nations. The restraints are economic, politicial, social, and time. The technological key to such a future is the control of energy to produce goods and services, and electricity has become the most effective and flexible energy intermediary. Freedom from basic wants as an end goal is served by electrification, and its steady expansion worldwide gives evidence of the pragmatic recognition of its usefulness.

# Creativity and Finance

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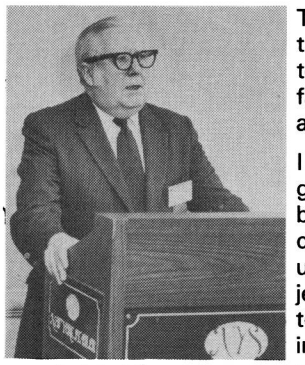

*J. V. Thornton*

The other lecturers have referred to the big gap between what modern technology can do for the homes, factories and offices of this country, and what it is doing.

I believe that a major reason for this gap is the inability of today's business managers and financiers to carry out ideas and plans. They are unable to finance and build the projects which creative minds continue to conceive. This inability has greatly increased as compared to earlier periods in the country's history.

By this I do not mean that there is a shortage of people who are knowledgeable about finance or construction. Schools of business have proliferated at an enormous rate since World War II. There are now more people in this country with extensive financial training than ever before. There are also plenty of experts in engineering and construction.

Nor is the problem an unwillingness of people to work hard today. True there are not many certified workaholics like Thomas Edison for whom the Puritan work ethic seems to have been a constant imperative of conscience. Edison averaged nineteen and a half hour working days until he was 55 years old and then he cut down to eighteen hour days. He had no recreations nor hobbies, he consumed large quantities of coffee and cigars, and he never exercised. But, if most of us do not have the dedication nor the cigar-smoking capacity of an Edison, we probably work just as hard as the average executive or professional of his day.

The big problem, as I see it, is that this country has built into its governmental system a series of intolerable restraints on the financing and implementation of creative ideas. These are restraints which Thomas Edison and others of his era did not have to face. The restraints have been imposed with the aim of protecting society, but they have become so cumbersome as to do great harm to society.